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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P 5247 PC00	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/IS 03/00032	International filing date *(day/month/year)* 28.10.2003	Priority date *(day/month/year)* 28.10.2002
International Patent Classification (IPC) or both national classification and IPC F21V29/00		
Applicant ~~JONSSON, Thorgeir et al~~ DATALIGHT CORPORATION		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

I	☒	Basis of the opinion
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☐	Certain defects in the international application
VIII	☐	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
28.05.2004	08.03.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Goltes, M Telephone No. +49 89 2399-6001

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IS 03/00032

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-14	as published

Claims, Numbers

7-22	received on 28.01.2005 with letter of 24.01.2005
1-6	received on 17.02.2005 with letter of 11.02.2005

Drawings, Sheets

1/3-3/3	as published

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-22
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-22
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-22
	No:	Claims	

2. Citations and explanations

   see separate sheet

Re Item V

The document D2 (EP-A-1 067 332) is regarded as being the closest prior art.
It discloses a light illuminating device comprising all features of the preamble of apparatus claim 1 and method claim 18 respectively (Paragraphs 4-27; figures 1-3).

The subject-matter of claim 1 (and claim 18 respectively) differs from this known from D2 in that the TEM (thermoelectric module) is configured and TOC (TEM-operating current) adjusted such that it produces more illumination per unit consumed power (it consumes less overall power per amount of emitted light respectively) when a TEM-operating current is applied to the TEM, than the illumination produced per unit consumed power (as compared to the overall power per same amount of light respectively) when no TEM-operating current is applied to the TEM.

The subject-matter of claim 1 and claim 18 respectively is therefore new (Art. 33(2) PCT).

The problem to be solved by the present invention may be regarded as to improve the overall effectiveness of the light illuminating device.

The solution to this problem proposed in claim 1 and claim 18 respectively of the present application is considered as involving an inventive step (Art. 33(3) PCT) for the following reasons:
None of the available prior art documents discloses the adjustment of the TOC in such a way, that the overall consumed power per amount of emitted light of the illumination device when a TOC is applied to the TEM is lower as compared to the overall power per same amount of light when no TEM-operating current is applied to the TEM.
In D1 (WO 00/37314 A) an operating current is adjusted on the necessary value to maintain the peak emission of IR diode (page 5). There is no mentioning of the relationship between the TOC and consumed power.
In D2 fewer LEDs can be used at the same amount of illumination using the TEMs. The different TOCs are applied at different temperatures to maintain the necessary illumination produced. There is also no mentioning of the relationship between the TOC and consumed power.
There is no mentioning of TEMs in D3 (WO 01/58218 A) at all.

Claims 2-17,19-22 are dependent on claim 1 and claim 18 respectively and as such also meet the requirements of the PCT with respect to novelty and inventive step.

AMENDED CLAIMS, 11 FEB 2005

1. A light illuminating device comprising:
   a. at least one light emitting diode (LED) (10),
   b. at least one thermoelectric module (TEM) (3) having a first surface which is thermally connected to the LED,
   c. a heat sink (7) thermally connected to a second surface of the at least one TEM,
   d. a thermally insulating cover creating an enclosed chamber substantially insulating the LED from ambient air,

   wherein said device is characterized by that the TEM is configured and TOC adjusted such that it produces more illumination per unit consumed power when a TEM-operating current is applied to the TEM, than the illumination produced per unit consumed power when no TEM-operating current is applied to the TEM.

2. The device of Claim 1, wherein the at least one TEM is configured such that the device is operated by running a TEM-operating current (TOC) through the TEM, which current is less than 20% of the maximum operating current for the TEM, thereby preventing a decrease in light output due to an increase of the temperature of the LED(s).

3. The device of Claim 2, wherein the at least one TEM is configured such that the device is operated by running a TOC through the TEM, which current is less than 15% of the maximum operating current for the TEM.

4. The device of Claim 1, wherein the TEM is configured such that the operating temperature of the LED(s) is lower than or about the same as the ambient temperature surrounding the device.

5. The device of Claim 1, wherein the TOC for each of said at least one TEM is in the range of 200-600 mA when using a TEM with a maximum TOC of about 3.0 A.

6. The device of Claim 5, wherein the TOC for each of said at least one TEM is in the range of 250-500 mA when using a TEM with a maximum TOC of about 3.0 A.

7. The device of Claim 1, wherein the TEM has a coefficient of performance (COP) during normal operation in the range of about 2-6.

8. The device of Claim 1, comprising a plurality of LEDs.

9. The device of Claim 1, comprising a plurality of TEMs.

10. The device of Claim 1, comprising a plurality of TEMs thermally connected in a stacked fashion.

11. The device of Claim 1, wherein the enclosed chamber has a higher pressure than ambient pressure, during normal operation.

12. The device of Claim 1, wherein the enclosed chamber has a lower pressure than ambient pressure, during normal operation.

13. The device of Claim 1, further comprising a control unit for controlling the TOC, and one or more sensors connected to the control unit for sensing one or more environmental parameters, wherein the control unit is configured to adjust the TOC based on parameters measured by the one or more sensors.

14. The device of Claim 13, wherein said one or more sensors comprise a temperature sensor for measuring the *in situ* temperature surrounding the LED(s).

15. The device of Claim 13, wherein said one or more sensors comprise a sensor for measuring emitted light from the LED(s)

16. The device of Claim 13, which is operated with pulsed current to the one or more LEDs.

17. The device of Claim 1 which device is configured for an application selected from traffic lights, illuminated roadway and/or emergency signs, airport runway lights, vehicle lights including brake lights.

18. A method for enhancing the efficiency of an light illuminating device having one or more LEDs as a light source, comprising:

a. providing the device with one or more thermoelectric module(s) (TEM) having a cold surface and a hot surface, such that the cold surface is thermally connected to the LED and the hot surface is thermally connected to a heat sink,

b. applying a TEM-operating current (TOC) to the one or more TEMs to create a temperature gradient through the TEM,

c. adjusting the TOC such that substantially all of the thermal energy created by the LED(s) when operated is transferred to the heat sink, thereby substantially maintaining the operating temperature of the LED(s) at ambient temperature or a lower temperature,

characterized in that the TEM is configured and TOC adjusted such that the device consumes less overall power per amount of emitted light when the TEM is running as compared to the overall power per same amount of light when the device is operated without applying a TOC to the TEM.

19. The method of Claim 19, wherein the TOC is less than 20% of the maximum operating current for the one or more TEMs.

20. The method of Claim 19, wherein the TOC is less than 15% of the maximum operating current for the one or more TEMs.

21. The method of claim 19, wherein the TOC for each of said at least one TEM is in the range of 200-600 mA when using a TEM with a maximum TOC of about 3.0 A.

22. The method of claim 20, wherein the TOC for each of said at least one TEM is in the range of 250-500 mA when using a TEM with a maximum TOC of about 3.0 A.